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GEOTECHNICAL INVESTIGATION REPORT
PROPOSED MATADERO CREEK U-FRAME CHANNEL
BETWEEN STATION 183+50 AND 198+95
PALO ALTO, CA

For

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118

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March 15, 1990

Job No. 89148.10

Page

SUMMARY OF DISCUSSIONS AND RECOMMENDATIONS 1

INTRODUCTION 2

PURPOSE AND SCOPE 3

SITE DESCRIPTION 5

FIELD EXPLORATION 6

LABORATORY TESTING 7

SUBSURFACE CONDITIONS 7

SEISMICITY 9

CONCLUSION AND RECOMMENDATIONS 10

- General 10
- Foundation Support 11
- Liquefaction Potential 11
- Lateral Resistance 12
- Excavation During Construction 13

    1. Temporary Slopes 13
    2. Shoring 13
    3. Dewatering 15

- Site Preparation and Grading 16
- Lateral Earth Pressure for Permanent Subsurface Wall Design 17
- Drainage 19
- Contamination Check 19
- Plan Review 20
- Construction Observation 20

INVESTIGATION LIMITATIONS 20

SITE PLAN Plate 1

TABLE OF CONTENTS

	Page
LOG OF BORINGS	Plates 2 thru 14
SOIL CLASSIFICATION CHART & KEY TO BORING LOGS	Plate 15
ESTIMATED LATERAL EARTH PRESSURE FOR TEMPORARY BRACED SHORING	Plate 16
LABORATORY TESTS	Appendix A
Classification Tests	A-1
Moisture-Density	A-1
Strength Tests	A-2
SUMMARY OF LABORATORY TESTS RESULTS	Plate A-1
PLASTICITY CHART	Plate A-2
GRAIN SIZE CLASSIFICATION	Plate A-3
SHEAR TEST DIAGRAM	Plate A-4 thru A-9
UNCONFINED COMPRESSION TEST DATA	Plate A-10
COMPACTION TEST DATA	Plate A-11
RECOMMENDED GENERAL GRADING SPECIFICATIONS	Appendix B
CONTAMINATION ANALYSIS DATA (Furnished by Trace Analysis Laboratory, Inc.)	Appendix C

GEOTECHNICAL INVESTIGATION REPORT

MATADERO CREEK U-FRAME CHANNEL

STATION 183+50 TO 198+95

PALO ALTO, CALIFORNIA

SUMMARY OF DISCUSSIONS AND RECOMMENDATIONS

Based upon our field exploration and laboratory test data, it is our opinion that the proposed project is feasible from a geotechnical engineering standpoint.

The subsurface soil conditions consist of layers of stiff sandy clay and medium dense to dense clayey sand and gravelly sands.

Temporary slopes in native soils not steeper than 1-1/2 to 1 (Horizontal to Vertical) may be used during construction. Where space constraint prohibits the use of open cut for excavation, shoring may be required. Recommended lateral earth pressures are provided in this report for temporary braced shoring design.

Minimum 12-inch thick drainage blanket consisting of CalTrans Class II permeable drain material, wrapped with filter fabric should be used under the proposed U-frame channel structure.

The text of this report should be referred to for detailed conclusions and recommendations.

INTRODUCTION

This report presents the results of our soil investigation for the proposed Matadero Creek U-frame Channel from Park Boulevard to El Camino Real in the City of Palo Alto, California. The location of the project site is shown on the Site Plan, Plate 1. We understand that the proposed project will consist of replacing the existing concrete lined channel between Park Boulevard and El Camino Real with a new reinforced concrete U-frame channel to improve the flow capacity of the existing Matadero Creek channel.

Based on our discussions and the two drawings provided by Santa Clara Valley Water District (SCVWD) - Sheets 10 and 11 of "Matadero Creek General Plan, Flood Basin to Foothill Expressway (both dated February 1, 1988)", the new U-frame channel will extend from approximately Station 183+50 to 198+95 with a total length of approximately 1545 feet. The proposed U-frame channel will be approximately 25 feet wide and 15 feet deep, constructed of cast-in-place reinforced concrete. This section will be about 2.5 feet deeper than the existing concrete channel. Two maintenance ramps are proposed on the east side of the channel between approximately Stations 189+16 and 191+00. A third maintenance ramp is also proposed on the west side of the channel between approximately Stations 183+12 and 183+95.

PURPOSE AND SCOPE

The purpose of this investigation was to conduct subsurface soil exploration, laboratory testing, and engineering analyses to develop our conclusions and recommendations for excavation stability, lateral pressures, drainage, temporary shoring requirements and foundation recommendations for the proposed U-frame Channel between Stations 183+50 and 198+95. The two aforementioned drawings (Sheets 10 and 11 of the "Matadero Creek General Plan") and our discussions with SCVWD have formed the basis of this investigation.

The scope of work, as outlined in our proposal dated July 19, 1989, consisted of the following:

1. Review readily available soil reports and geologic literature pertaining to the project.
2. Drill four geotechnical borings to maximum depths of 41.5 feet and obtain soil samples for laboratory tests. One additional boring was drilled to a depth of 16.5 feet for the purpose of collecting samples for contamination check only.
3. Classify and continuously log the soils and groundwater encountered in each test boring at the time of drilling.

4. Collect and send 2 samples to an EPA approved analytical laboratory for contamination check as per the EPA priority pollutant list.
5. Perform laboratory tests on representative samples obtained from our test borings to evaluate the engineering characteristics of the subsurface soils.
6. Perform engineering analysis to furnish conclusions and recommendations regarding the following:
    - Suitable foundation type(s) for the U-frame structure and allowable soil supporting capacities to be used in foundation design.
    - Temporary cut slopes during construction.
    - Site preparation, excavation and backfill requirements.
    - Suitability of on-site soil for backfill material.
    - Lateral pressures for temporary braced shoring design.
    - Lateral pressures on the U-frame channel walls.
    - Passive pressures to resist lateral loads.
    - Seismic considerations including liquefaction potential and dynamic lateral pressures for the channel walls.
    - Drainage and erosion control.
7. Summarize the results of our investigation in a written report.

This report covers only the portion of the proposed U-frame Channel between approximately Stations 183+50 to Station 198+95. The proposed box culvert bridges at Park Boulevard and Lambert Avenue are not included in this investigation.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a small contingency fund be provided to accommodate additional charges resulting from technical services that may be required during construction.

SITE DESCRIPTION

The proposed site of the U-frame channel is located within the right-of-way of the existing Matadero Creek alignment between Park Boulevard and El Camino Real in the City of Palo Alto, California. The bottom and sideslopes of the existing channel are covered with concrete lining to within about 1 foot from the top of the channel. The bottom of the creek is relatively flat. Less than three inches of water was observed flowing in a northerly direction at the bottom of the channel during our field exploration in November 1989. There are chain link fences running along both sides of the existing channel right-of-way. Between El Camino Real and Lambert Avenue, the banks on both sides of the creek are unpaved and are very narrow, less than 3 feet wide. Between Lambert Avenue and Park Boulevard, a 9 to 12 feet wide unpaved road is maintained along the east side of creek. There is an existing maintenance ramp on the east side of the channel between Stations 185+00 and 185+50 which extends from the bank to the bottom of the channel. The west creek bank between Lambert Avenue and Park Boulevard is unpaved and has very limited access, less than approximately three feet.

FIELD EXPLORATION

In accordance with our proposal dated July 19, 1989, four test borings (B-1 through B-4) were drilled to 41.5 feet at locations shown on Plate 1. One additional boring (B-5) was drilled for the purpose of collecting samples for contamination check only. The location of B-5 is also shown on Plate 1.

The test borings were advanced with a truck mounted drill rig using eight-inch diameter hollow stem augers. Soil samples at various depths were obtained either using a Modified California Sampler (3-inch O.D. and 2.42-inch I.D.) or a Standard Penetration Sampler (2-inch O.D. and 1.38-inch I.D.). Both samplers were driven into the soil using a 140-pound hammer falling 30 inches. The samples were then transported to our laboratory for further evaluation and testing. The soils encountered, sample locations, ground surface elevations and resistance to sampler penetration (blow count) are presented in "Logs of Test Borings", Plates 2 to 14. The soils are classified in accordance with the Unified Soil Classification Chart presented on Plate 15.

LABORATORY TESTING

Samples collected from the field exploration were re-examined in our laboratory to confirm their field classification and representative samples were selected for testing. The testing program included moisture content, dry density determination, direct shear and unconfined compression strength tests, Atterberg Limits, particle size analysis and laboratory compaction test. The description of these tests and their results are presented in Appendix A.

Two samples were analyzed for contamination as per the EPA priority pollutant list by Trace Analysis Laboratory, Hayward, California. The results of the contamination check are presented in Appendix C.

SUBSURFACE CONDITIONS

The subsurface soil conditions of the channel section between El Camino Real and Lambert Avenue, as revealed by test borings B-1 and B-2, consist of stiff to very stiff sandy clay, silty clay with some clayey sand and gravel in the upper 17 to 20 feet. These materials overlie gravelly sand, clayey sand and gravel to the bottom of the borings (approximately 41.5 feet).

The subsurface soil conditions of the channel section between Lambert Avenue and Park Boulevard, as revealed by test borings B-3 and B-4, consist primarily of stiff to very stiff sandy clay and silty clay to the maximum depth explored approximately 40 feet. At boring location B-3, gravelly sand was encountered between approximately 29 feet and 33 feet below the existing ground surface and also at the bottom of the boring. The soils encountered at B-5, which was drilled for the purpose of collecting samples for contamination check, were also logged. Stiff silty clay was encountered in the upper 9 feet. A layer of gravelly sand was encountered underneath the upper silty clay. Below the gravelly sand, a firm sandy clay was encountered to the bottom of hole at 16.5 feet.

Groundwater levels measured at our boring locations at the time of our drilling in November, 1989, range between 18 to 33 feet below the existing ground surface. However, these water levels were measured after a prolonged dry period and we believe that the water table may rise during the wet season. Also, we anticipate that there would be fluctuations in the groundwater level, or variations due to subsurface creek flow, rainfall, ground surface runoff or/and other factors that were not evident at the time of our investigation.

Detailed descriptions of the materials encountered in each of the exploratory borings are presented on Plates 2 through 14, "Logs of Borings". It should be noted that these descriptions and related information depict subsurface conditions only at the locations indicated on the designated boring locations and on the particular date noted on the logs. Because of the variability from place to place within soils in general, subsurface conditions at other locations may differ from conditions occurring at the locations explored. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes. We, therefore, recommend that this report not be relied upon for fixed bidding purposes. However, it can be used for reference purposes.

SEISMICITY

The San Francisco Bay Area is recognized by geologists and seismologists as one of the most active seismic regions in the United States. The significant earthquakes that have occurred in the Bay Area are associated with crustal movement which generally occurs along well defined, active fault zones that include the San Andreas, Hayward and Calaveras faults.

These faults are located approximate 6.8 miles southwest, 11.2 miles and 17.2 miles northeast of the site, respectively.

On the basis of current knowledge, it is reasonable to assume that the site will be subjected to at least one moderate to severe earthquake during the life of the proposed U-frame channel structure.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the findings of our investigation, the proposed project is feasible from a geotechnical engineering standpoint provided the recommendations presented herein are incorporated into the final design and construction of the proposed improvements.

This report was prepared specifically for the channel between Stations 183+50 and 198+95 as shown on Plate 1. Normal construction procedures were assumed throughout our analysis and represent one of the basis of recommendations presented herein.

Foundation Support

Based on our understanding of the present project plan, the existing soil data available to us and those obtained from our test borings, we anticipate that the bottom of the U-frame channel structure will be located approximately 15 feet below the existing ground surface, most likely to be in the native silty sandy clay or clayey sand for much of its length. We recommend that the channel bottom slab be designed as a continuous mat foundation to provide support of the U-frame channel. A maximum allowable bearing pressure of 2,500 pounds per square foot (psf) can be used for foundation design, provided that the soils beneath the channel are not disturbed during construction.

Liquefaction Potential

Liquefaction could occur in saturated, loose granular soils when the pore water pressure build-up during seismic shaking equals or exceeds the confining pressure of the soils and subsequently cause a significant reduction in the soil strength.

Based on the results of our soil evaluation, the subsurface soils below the groundwater table in general are dense to very dense in nature. We believe that the liquefaction potential for these soils during earthquake is low.

Localized loose sand lenses within the soils deposits may liquefy and temporarily lose its strength; however, we believe that the effect of localized liquefaction on foundation support of the U-frame channel will be minimum.

Lateral Resistance

Resistance to lateral loading may be provided by sliding friction acting on the base of the foundation slab and by passive earth pressure.

An allowable coefficient of friction of 0.35 may be used for underlying soils with respect to vertical dead load forces only.

Passive earth pressure of undisturbed or compacted soils may be computed at an equivalent fluid having a density of 250 pounds per cubic foot. In the event passive earth pressure and friction are combined for lateral resistance, the passive component should be reduced by one-third.

Excavation During Construction

1. Temporary Slopes

Where space permits, the sides of the excavations can be maintained by unretained slopes. In general, temporary open cut slopes in soils similar to those encountered in our borings may be cut at slope gradient not steeper than 1-1/2 to 1 (H:V) under normal dry site conditions, provided that it does not interfere with any of the existing foundation adjacent to the open excavation. A minimum setback of 5 feet between the adjacent shallow foundations and the top of the cut should be maintained throughout the excavation. All excavation should also meet the current safety criteria of OSHA.

Considering the proximity of the adjacent properties to the proposed construction, it is very likely that shoring may be required. General requirements for shoring are discussed in the following paragraph.

2. Shoring

Where space does not permit the excavation to be performed by open cut, shoring system may be necessary to retain the sides of the excavation. Of the various methods for making braced excavation, it is likely that a soldier pile and lagging system would be the most economical, provided the subsurface soil and groundwater conditions do not deviate significantly from those revealed by our test borings. As an alternative, sheet piles can be considered. It is the responsibility of the contractor to select the shoring system, provided that the excavation will be performed in a safe and workable condition.

Shoring systems should be designed to minimize the potential for any movement of the adjacent ground. We recommend that settlement markers be installed outside the shoring limits to monitor movements. This instrumentation should be placed after initial shoring work is completed and prior to excavation. The instruments should be monitored at frequent intervals according to the progress of excavation. Standard surveying equipment also should be used to monitor shoring movements on a periodic basis during construction. The monitoring could be a basis for evaluating any claims by public agencies or private property owners.

Recommended lateral earth pressures for use in computing loads on braced shoring systems should consist of a trapezoidal pressure diagram shown on Plate 16. If water is encountered, a hydrostatic (triangular) pressure of water weighing 62D pounds per square foot should be added to the soil pressure diagram, where D is the height of the anticipated seepage water column to the bottom of the excavation. Details of these are shown on Plate 16. Any traffic load and surcharge (such as stockpile material or nearby residential structures) within fifteen feet of the top of the excavation should be considered in the shoring design. Foundations that could be undermined due to proposed cuts should be shored or supported by appropriate system.

The above recommendations are general requirements for shored excavation at the project site. The shoring design should be performed by a licensed civil engineer. The above requirements should be checked and modified (if required) according to the shoring system selected.

3. Dewatering

Should construction phase start when groundwater level is at its peak elevation and water seepage is evident in the cut slopes, dewatering would be required to allow construction be performed. Based on the subsurface soil conditions revealed by our test borings in the upper 15 feet, we anticipate that temporary sump and pump system would be feasible to dewater the construction area, if free water encountered during construction. The Soils Engineer should be notified immediately if such conditions are encountered during the construction phase so that additional recommendations can be provided in a timely manner.

Site Preparation and Grading

We anticipate that site grading will primarily consist of excavation to the proposed bottom level of the U-frame channel and also overexcavation to remove unsuitable soils, if present. As each excavation is completed, the exposed bottom of excavation which will serve as the foundation subgrade should be proof-rolled by a compactor and approved by the soil engineer at the time of grading. If any soft spot is detected after the excavation, the soft material should be overexcavated. The void resulted from the overexcavation should be backfilled with recompacted engineered fill.

In areas where fill will be required to bring up the exposed surface after overexcavation, the surface should be scarified to a depth of six inches, moisture conditioned and compacted to 90% relative compaction in accordance with ASTM D1557-78 method.

Fill placement should be performed in lifts less than 8 inches in loose thickness, moisture conditioned and compacted to 90% of maximum dry density. All structural backfill such as that behind the channel walls or utility trenches should be moisture conditioned and properly compacted to at least 90% of maximum dry density in accordance with ASTM D1557-78 method.

On-site soils similar to those encountered in the borings along the proposed alignment may be used as backfill at areas at least 4 feet away from wall, any pipes or structural elements, provided it is free of any contaminants and/or deleterious material, contains particles no larger than 6 inches in sizes, plasticity index less than 20 and is judged suitable by our engineer at the field during site grading. Some of the on-site soils which are relatively more expansive, having plasticity index equal or higher than 15 should not be used within 4 feet of the channel wall or any structural element.

Import material, if used for fill, should be predominantly sandy soils, free of organic or any deleterious material, should have particle no greater than 6 inches in greatest dimension, and should be non-expansive in nature (liquid limit less than 30, plasticity index less than 12).

All grading operations shall conform to CalTrans standard specifications.

Lateral Earth Pressures For Permanent Subsurface Wall Design

Rigid channel walls can be designed to resist an equivalent fluid pressure of 60 pounds per cubic foot (pcf). This pressure is essentially the at-rest pressure appropriate for walls restrained from movement at their top. For walls which are allowed to deflect slightly at the top, an active lateral earth pressures equivalent to a fluid weighing 40 pcf can be considered.

All surcharge loads should be added to the horizontal loads on the wall at a rate of 30% of the total applied load. If dynamic soil pressure is considered for the channel walls under earthquake condition, we recommend that an uniform pressure of 330 pounds per square foot (psf) be added.

Based on our laboratory testing and field observations, a dark brown silty clay was encountered in the upper 15 feet of our test borings which has a moderate expansion potential (i.e. potential to swell and shrink with variations in moisture content). We recommend that this type of soil not be reused as backfill within 4 feet behind the channel wall as discussed in the section "Site Preparation and Grading". Otherwise, the wall should be designed for the additional expansion pressure. Also, any expansive soils exposed at the face or the bottom of the excavation during site grading should be continually kept moist to about 2% above optimum moisture content until covered with concrete.

In order to relieve hydrostatic pressures along the sides of the channel, it may be prudent to design one-way hydrostatic pressure relief valves in the walls. The inlets to the valves should be protected by Class II permeable drain and fabric. These may be spaced at frequent intervals so that the outside water level could be lowered without incurring high buoyancy conditions inside the channel.

Drainage

We recommend a minimum 12-inch thick drainage blanket consisting of CalTrans Class II permeable material, wrapped with filter fabric should be used under the U-frame channel. The drainage blanket should be directed to approved discharge point. A 1.0% flow gradient should be maintained along the entire drainage blanket bed. This proposed drainage blanket would allow subsurface creek flow to drain in a contained system, thereby reducing potential for soil erosion or piping.

CONTAMINATION CHECK

As proposed two soil samples were taken for chemical analysis for EPA priority pollutants and metals. The results of these analyses are presented in Appendix C. Based on comparison with Title 22 and Department of Health Services standards, Toluene and 1.2-Dichloroprone exceeded maximum contaminant levels.

Contaminated soil will not be suitable for backfill and should be removed and hauled to an approved dump site suitable for the type of contaminants present.

Please note that the tests were taken at the designated locations on the plan and the source and the total extent of the contamination is not known.

However the tests we were authorized to conduct have revealed the soil and water contamination. Based on this, the material is not suitable for the backfill operations. It should be noted that this may not eliminate future problems or contamination of the newly placed fill. If further information is needed as to the total extent of the contamination and it's source, it would require an in depth contamination study and appropriate remedial measures that may extend beyond the project limits. This work is outside our scope of service.

The Department of Health Services should be contacted to discuss formal reporting requirements for the contaminated soil and water.

Monitoring during construction is recommended and health and safety provisions for workers should be provided as necessary.

As an alternate measure, soil and water could be treated on site according to Department of Health Services or Regional Water Quality Control Board requirements.

Plan Review

Foundation and grading should be reviewed by this office prior to construction so that the intent of our recommendations are used in the project plans and specifications and to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon constructions procedures and quality. Hence, observation of subgrade preparation, density testing of fill and subgrades, and observation of foundation excavations should be carried out by this firm in order to minimize misunderstandings by the involved parties of both the letter and the spirit of our report as well as to note any subsurface conditions different from those forming the basis of our recommendations. Therefore, the recommendations presented in this report are contingent upon these geotechnical observations and tests during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations, based on our site reconnaissance and the assumption that the soil information does not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and drilling test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project.

This report has been prepared in order to provide geotechnical assistance to the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes are reviewed and the recommendations modified or approved by us in writing.

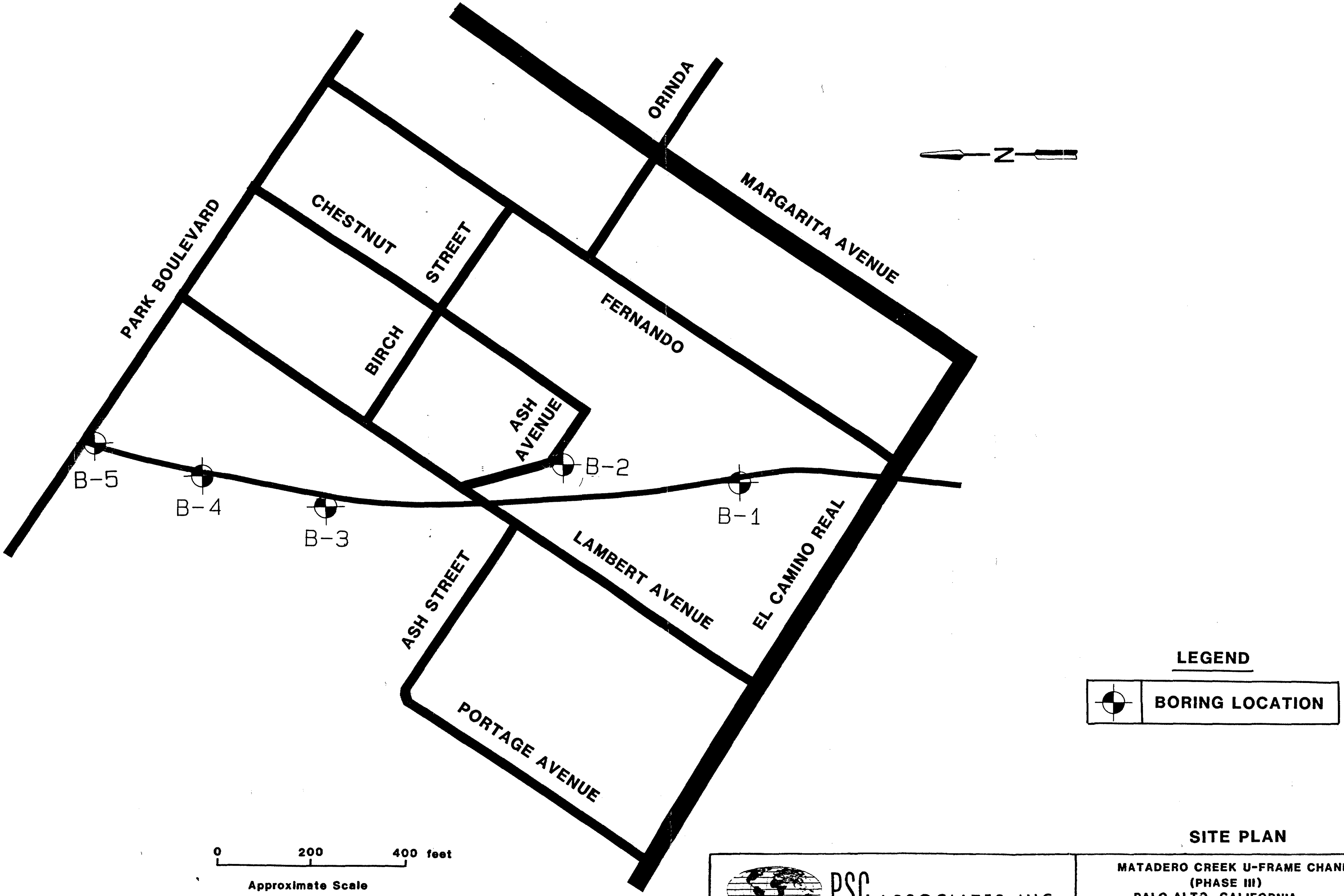
The findings in this report are valid as of the present date. However, changes in the conditions of the property can occur with the passage of time, whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Therefore, this report is subject to review by the controlling government agencies and is valid for a period of one year.

Very truly yours,

P S C ASSOCIATES, INC.

Gary Parikh
G.E. 666



SITE PLAN

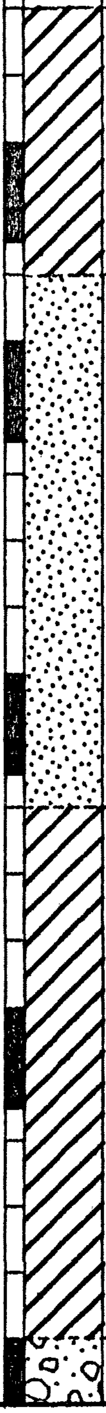
MATADERO CREEK U-FRAME CHANNEL
(PHASE III)
PALO ALTO, CALIFORNIA

PSC ASSOCIATES, INC.
SOILS, FOUNDATION AND GEOLOGICAL ENGINEERS

DATE : 11-10-89
JOB NO : 89148.10

PLATE 1

BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/8/89	**DRILLING METHOD** Truck mounted 8" diameter hollow stem auger	**BORING NUMBER** B-1
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	**SHEET 1 OF 1**

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					0		CL	FILL 3" Asphalt Concrete and 6" Aggregate Base. Brown silty CLAY with some sand and gravel, slightly moist, very stiff.
					1			
MC	42		14.7	1-1	2			
					3			
					4		SP	Brown gravelly SAND with some clay, slightly moist, dense.
MC	55			1-2	5			
					6			
					7			NATIVE
					8			Brown gravelly SAND with some clay, slightly moist, dense with lenses of dark clay.
					9			
MC	70/11"	119.8	15.8	1-3	10			Becomes clayey and contains traces of tree roots.
					11			
					12		CL	
					13			Brown sandy CLAY with some gravels, moist, stiff.
					14			
MC	30			1-4	15			Some sand lenses.
					16			
					17			
					18			
					19			
					20		GP	▽ Groundwater initially encountered at 20'.
MC	20			1-5				Brown and gray sandy GRAVEL, wet, medium dense.

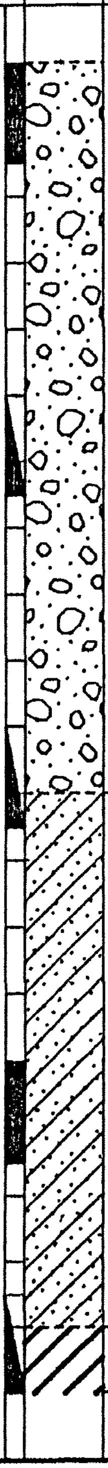
LOG OF BORING

PSC ASSOCIATES INC.	*Soils Foundation & Geological Engineers*	Matadero Creek U-Channel
		DATE: 12/89
		JOB NO: 89148.10

PLATE 2

BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/8/89	DRILLING METHOD Truck mounted 8" diameter hollow stem auger	BORING NUMBER B-1
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 2 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	U.S.C.S.	
					20	GP ▽	Groundwater initially encountered at 20'.
MC	20			1-5	21		Brown and gray sandy GRAVEL, wet, medium dense.
					22		
					23		
					24		
SPT	22		9.1	1-6	25		
					26		
					27		
					28		
					29		
SPT	18			1-7	30		
					31	SC	Brown clayey SAND, wet, medium dense.
					32	▼	Groundwater at 32' at the end of drilling.
					33		
					34		
MC	30	20.4	107.4	1-8	35		
					36		
					37		
					38		
SPT	13			1-9	39	CL	Brown sandy CLAY, wet, stiff.
					40		



LOG OF BORING

PSC
ASSOCIATES INC.

Soils
Foundation &
Geological
Engineers

Matadero Creek
U-Channel

DATE: 12/89
JOB NO: 89148.10

PLATE 3

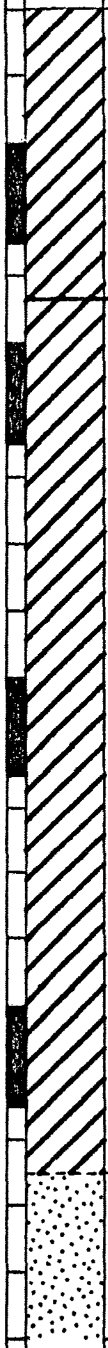
BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/8/89	DRILLING METHOD Truck mounted 8" diameter hollow stem auger	BORING NUMBER B-1
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 3 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					40			
					41			Boring terminated at 40'. Groundwater initially encountered at 20' dropping to 32' at end of drilling.
					42			
					43			
					44			
					45			
					46			
					47			
					48			
					49			
					50			
					51			
					52			
					53			
					54			
					55			
					56			
					57			
					58			
					59			
					60			

LOG OF BORING

PSC ASSOCIATES INC.	*Soils* *Foundation &* *Geological* *Engineers*	Matadero Creek U-Channel
	DATE: 12/89	JOB NO: 89148.10

BORING LOCATION, ELEVATION, AND DATE DRILLED	DRILLING METHOD	BORING NUMBER
See Site Plan, Plate 1 11/8/89	Truck mounted 8" diameter hollow stem auger	B-2
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 1 OF 3



SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	U.S.C.S	
					0	CL	FILL
					1		
MC	30	104.6	21.7	2-1	2		Dark brown sandy CLAY with traces of gravel, slightly moist, stiff.
					3		
					4		
MC	34			2-2	5		NATIVE Brown sandy CLAY with traces of gravel, slightly moist, stiff.
					6		
					7		
					8		
					9		Light brown silty CLAY, very moist, stiff, some gravel.
MC	22	106.8	21.8	2-3	10		
					11		
					12		Occassionally dark brown silty CLAY.
					13		
					14		Becomes light brown and white at 14'.
MC	58			2-4	15		
					16		
					17		
					18	SP	Brown gravelly SAND, dense, wet.
					19		
					20		

LOG OF BORING

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Matadero Creek
U-Channel

DATE: 12/89

JOB NO: 89148.10

PLATE 5

BORING LOCATION, ELEVATION, AND DATE DRILLED	DRILLING METHOD	BORING NUMBER
See Site Plan, Plate 1 11/8/89	Truck mounted 8" diameter hollow stem auger	B-2
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 2 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	U.S.C.S	
					20	SP	Groundwater encountered at 20' at time of drilling. Brown gravelly SAND, wet, dense.
MC	65			2-5	21		
					22		
					23		
					24		
SPT	32			2-6	25		
					26		
					27		
					28		
					29		
MC	53			2-7	30		Brown and gray gravelly SAND with some clay, wet, medium dense.
					31		
					32		
					33		
					34		
SPT	40			2-8	35		Dense at 35'.
					36		
					37		
					38		
					39		
SPT	17			2-9	40		Brown and gray poorly graded SAND with traces of clay, wet, medium dense.

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PLATE 6

BORING LOCATION, ELEVATION, AND DATE DRILLED
See Site Plan, Plate 1
11/8/89

DRILLING METHOD
Truck mounted 8" diameter
hollow stem auger

BORING NUMBER
B-2

SAMPLING METHOD
Mod. Calif. (MC) Std. Pen. Test (SPT)
140# hammer 30" drop

SHEET 3 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
SPT	17			2-9				
					40	░	SP	
					41	░		
					42			Boring terminated at 41.5'. Groundwater encountered at 20' at time of drilling.
					43			
					44			
					45			
					46			
					47			
					48			
					49			
					50			
					51			
					52			
					53			
					54			
					55			
					56			
					57			
					58			
					59			
					60			

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PLATE 7

BORING LOCATION, ELEVATION, AND DATE DRILLED	DRILLING METHOD	BORING NUMBER
See Site Plan, Plate 1 11/9/89	Truck mounted 8" diameter hollow stem auger	B-3
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 1 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					0	▨	CL	FILL 2.5" Asphalt Concrete and 2.5" Aggregate Base. Dark brown silty CLAY, moist, traces of fine gravel, stiff.
					1	▨		
MC	23			3-1	2	▨		
					3	▨		
					4	▨		
MC	22	92.5	28.6	3-2	5	▨		
					6	▨		
					7	▨		NATIVE Light brown sandy CLAY, very moist, traces of gravel.
					8	▨		
					9	▨		
MC	51			3-3	10	▨		Occasional brown and gray silty SAND lenses. Light brown silty CLAY with traces of sand and fine gravel, gray mottlings, stiff.
					11	▨		
					12	▨		
					13	▨		
					14	▨		
MC	26			3-4	15	▨		
					16	▨		
					17	▨		
					18	▨		Brown and gray sandy CLAY, very moist, firm.
					19	▨		
MC	17	96.3	27.6	3-5	20			

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PLATE 8

BORING LOCATION, ELEVATION, AND DATE DRILLED	DRILLING METHOD	BORING NUMBER
See Site Plan, Plate 1 11/9/89	Truck mounted 8" diameter hollow stem auger	B-3
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 2 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
MC	17	96.3	27.6	3-5	20	▨	CL	Brown and gray sandy CLAY, very moist, firm.
					21	▨	▽	Groundwater initially encountered at 21'.
					22	▨		
					23	▨		Brown sandy CLAY, wet, stiff.
					24	▨	▼	Groundwater at 24.5' at the end of drilling.
SPT	13			3-6	25	▨		
					26	▨		
					27	▨		
					28	▨		
					29	▨		
SPT	32			3-7	30	░	SP	Gray and brown gravelly SAND, wet, dense.
					31	░		
					32	░		
					33	▨	CL	Brown sandy CLAY, traces of silt and gravel, wet, stiff.
					34	▨		
SPT	16			3-8	35	▨		
					36	▨		
					37	▨		
					38	▨		Gray sandy CLAY, traces of silt and gravel, wet, stiff.
					39	░	SP	Gray gravelly SAND, some silt and clay, wet, dense.
MC	60/10"			3-9	40			

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DATE: 12/89

JOB NO: 89148.10

BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/9/89	DRILLING METHOD Truck mounted 8" diameter hollow stem auger	BORING NUMBER B-3
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 3 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
MC	60/10"			3-9	40			
					41			Boring terminated at 40'. Groundwater initially encountered at 21' dropping to 24.5' at end of drilling.
					42			
					43			
					44			
					45			
					46			
					47			
					48			
					49			
					50			
					51			
					52			
					53			
					54			
					55			
					56			
					57			
					58			
					59			
					60			

LOG OF BORING

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PLATE 10

BORING LOCATION, ELEVATION, AND DATE DRILLED	DRILLING METHOD	BORING NUMBER
See Site Plan, Plate 1 11/9/89	Truck mounted 8" diameter hollow stem auger	B-4
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 1 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					0	▨	CL	FILL
					1	▨		3" Asphalt Concrete over 2" Aggregate Base.
MC	28			4-1	2	▨		Dark brown sandy CLAY, traces of silt and gravel, moist, stiff, some organics.
					3	▨		
					4	▨		
MC	20	93.9	29.3	4-2	5	▨		
					6	▨		Dark brown silty CLAY with some gravel, moist, stiff.
					7	▨		NATIVE Dark brown silty CLAY with gravel, moist, stiff, hard drilling.
					8	▨		
					9	▨		
MC	35			4-3	10	▨		
					11	▨		Light brown sandy CLAY, traces of gravel, moist, very stiff.
					12	▨		
					13	▨		
					14	▨		
MC	24			4-4	15	▨		Light brown sandy CLAY, traces of gravel, moist, stiff.
					16	▨		
					17	▨		
					18	▨	▽	Groundwater at 18' at end of drilling.
					19	▨		**Light brown silty CLAY, traces of silt and gravel, very moist, stiff.**
					20			

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PLATE 11

BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/9/89	DRILLING METHOD Truck mounted 8" diameter hollow stem auger	BORING NUMBER B-4
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 2 OF 3

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					20	▨	CL	Light brown silty CLAY, traces of sand and gravel, very moist, stiff.
MC	19	92.7	22.0	4-5	21	▨		
					22	▨		
					23	▨		
					24	▨		
MC	27			4-6	25	▨		
					26	▨		
					27	▨		
					28	▨		
					29	▨		
SPT	21			4-7	30	▨		Very stiff, becomes less gravelly.
					31	▨		
					32	▨		
					33	▨	∇	Groundwater initially encountered at 33'.
					34	▨		
MC	24			4-8	35	▨		Stiff at 35'.
					36	▨		
					37	▨		
					38	▨		**Pockets of coarse sand.**
SPT	14			4-9	39	▨		**Gray and brown silty CLAY, wet, stiff, traces of fine gravel.**
					40			

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BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/9/89	DRILLING METHOD Truck mounted 8" diameter hollow stem auger
BORING NUMBER B-4	SHEET 3 OF 3
SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					40			
					41			Boring terminated at 40'. Groundwater initially encountered at 33' rising to 18' at end of drilling.
					42			
					43			
					44			
					45			
					46			
					47			
					48			
					49			
					50			
					51			
					52			
					53			
					54			
					55			
					56			
					57			
					58			
					59			
					60			

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PLATE 13

BORING LOCATION, ELEVATION, AND DATE DRILLED See Site Plan, Plate 1 11/9/89	DRILLING METHOD Truck mounted 8" diameter hollow stem auger	BORING NUMBER B-5
	SAMPLING METHOD Mod. Calif. (MC) Std. Pen. Test (SPT) 140# hammer 30" drop	SHEET 1 OF 1

SAMPLER TYPE	NUMBER OF BLOWS/FT	DRY DENSITY PCF	MOISTURE CONTENT % DRY WT	SAMPLE NUMBER	DEPTH IN FEET	SOIL GRAPH	U.S.C.S	
					0	▨	CL	Dark brown silty CLAY, traces of gravel, moist, stiff.
					1	▨		
					2	▨		
					3	▨		
MC	17			5-1	4	▨		
					5	▨		
					6	▨		
					7	▨		
					8	▨		
					9	░	SP	Light brown gravelly SAND, some clay, moist.
					10	░		
					11	░		
					12	░		
					13	▨	CL	Light brown sandy CLAY with some gravel, moist, firm.
MC	16			5-2	14	▨		
					15	▨		
					16	▨		Boring terminated at 16.5'. Groundwater not encountered.
					17			
					18			
					19			
					20			

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DATE: 12/89

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SOIL CLASSIFICATION CHART & KEY TO BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE-GRAINED SOILS More than 50% retained on No 200 sieve*	GRAVELS 50% or more of coarse fraction retained on No 4 sieve	CLEAN GRAVELS	GW	○	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	●	Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVELS WITH FINES	GM	▥	Silty gravels, gravel-sand-silt mixtures.
			GC	▨	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than 50% of coarse fraction passes No 4 sieve	CLEAN SANDS	SW	°	Well-graded sands and gravelly sands, little or no fines.
			SP	•	Poorly graded sands and gravelly sands, little or no fines.
		SANDS WITH FINES	SM	▥	Silty sands, sand-silt mixtures
			SC	▨	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS 50% or more passes No 200 sieve*	SILTS AND CLAYS Liquid limit 50% or less		ML	▥	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	┆	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50%		MH	▥	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	▨	Inorganic clays of high plasticity, fat clays.
			OH	▨	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	≈	Peat, muck and other highly organic soils

■ **DMU, MOD. CALIFORNIA SAMPLER, driven by 140# hammer with 30" drop.**

◩ **Standard Penetration Test (SPT), driven by 140# hammer with 30" drop.**

☒ **Bulk sample**

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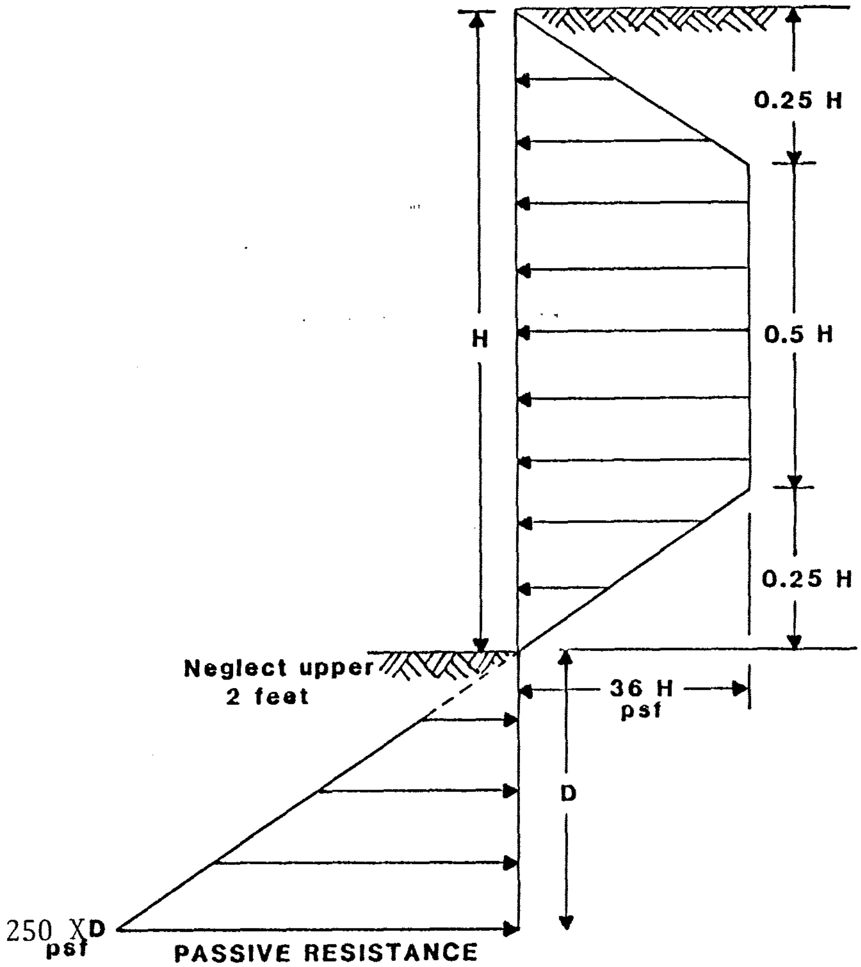
* Based on the material passing the 3-in (76-mm) sieve

ESTIMATED LATERAL EARTH PRESSURES FOR TEMPORARY BRACED SHORING



NOTE:

1. H and D are in feet.

2. The above pressure diagram does not include hydrostatic pressure. If the water is at different elevations on each side of the shoring, the effect of unbalanced hydrostatic pressure would need to be accounted for.

3. These pressures are based on soil conditions encountered in our test borings. Lateral earth pressures should be checked where conditions are different. All surcharge loads should be added to the horizontal loads at a rate of 30% of total applied loads.

4. Effective pile width for passive resistance calculation = 2 X width of soldier pile.

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MATADERO CREEK U-FRAME CHANNEL
BETWEEN PARK BOULEVARD AND
EL CAMINO REAL PALO ALTO, CALIFORNIA

DATE : 11-10-89

JOB NO : 89148.10

APPENDIX A

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on the Boring Logs, Plates 2 through 14.

Selected representative samples were also sieved to determine their grain size classification. The results are presented on Plates A-3, "Grain Size Classification".

The Atterberg Limits were determined for selected samples in order to classify the soil, as well as to obtain an indication of the expansion potential of the materials. The results of these tests are presented on "Plasticity Chart", Plate A-2.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the Boring Logs and on the "Summary of Laboratory Tests Results", Plate A-1.

Strength Tests

Strength tests were performed on selected undisturbed samples using unconfined compressive and direct shear test machines. The results are presented on "Summary of Laboratory Test Results", Plate A-1 as well as on Plates A-4 through A-10.

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Palo Alto, California

DATE : 12/1/89

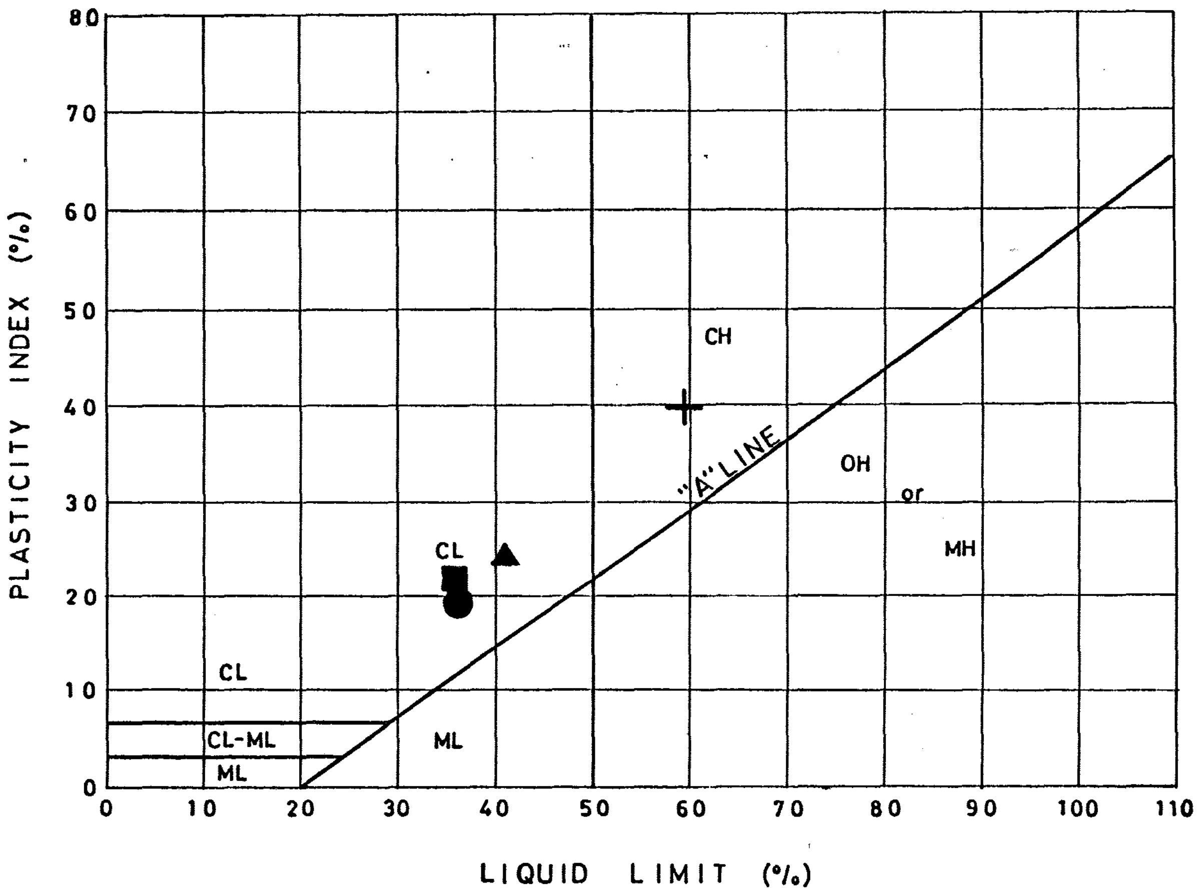
JOB NO : 89148.10

SAMPLE NO.	DEPTH ft	USCG*	GRAIN SIZE ANALYSIS			ATTERBERG LIMITS			STRENGTH PARAMETERS		MOISTURE CONTENT	DRY DENSITY	REMARKS
			GRAVEL %	SAND %	FINES %	LL %	PL %	PI %	C ksf	PHI degree	%	pcf	
Bulk 2	0-5	CL	2.1	28.7	69.2	40.1	16.6	23.5					See Grain Size Classification, Plate
1 - 1	2.0	CL				36.1	15.0	21.1			14.7		See Plasticity Chart, Plate
1 - 3	10.0	SC							0.4	31.7	15.8	119.8	See Shear Test Diagram, Plate
1 - 6	25.0	GW	63.8	29.9	6.3								See Grain Size Classification, Plate
1 - 8	35.0	SC							0.6	36.2	20.4	107.4	See Shear Test Diagram, Plate
2 - 1	2.0	CL							0.65	22.6	21.7	104.6	See Shear Test Diagram, Plate
2 - 3	10.0	CL							1.9	21.0	21.8	106.8	See Shear Test Diagram, Plate
3 - 2	5.0	CH				59.6	19.6	40.0			28.6	92.5	See Plasticity Chart, Plate
3 - 5	20.0	SC/CL							0.65	18.4	27.6	96.3	See Shear Test Diagram, Plate
4 - 2	5.0	CL							1.0	11.7	29.3	93.9	See Shear Test Diagram, Plate
4 - 3	10.0	CL							2.1		27.6	96.3	See Uncon. Comp. Test Diagram, Plate
4 - 5	19.5	CL				36.5	16.5	20.0			22.0	92.7	See Plasticity Chart, Plate
-													
-													
-													
-													
-													

*UNIFIED SOIL CLASSIFICATION SYSTEM

SUMMARY OF LABORATORY TEST RESULTS

PLASTICITY CHART



PLASTICITY DATA

KEY SYMBOL	HOLE NUMBER	DEPTH (FEET)	NATURAL WATER CONTENT W (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX $\left(\frac{W - PL}{LL - PL}\right)$	UNIFIED SOIL CLASSIFICATION SYMBOL
■	1	2	14.7	15.0	36.1	21.1		CL
▲	2	0-5	7.8	16.6	40.1	23.5		CL
+	3	5	28.6	19.6	59.6	40.0		CH
●	4	19.5	22.0	16.5	36.5	20.0		CL

% PASSING NO. 200 SIEVE

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PLATE A-2

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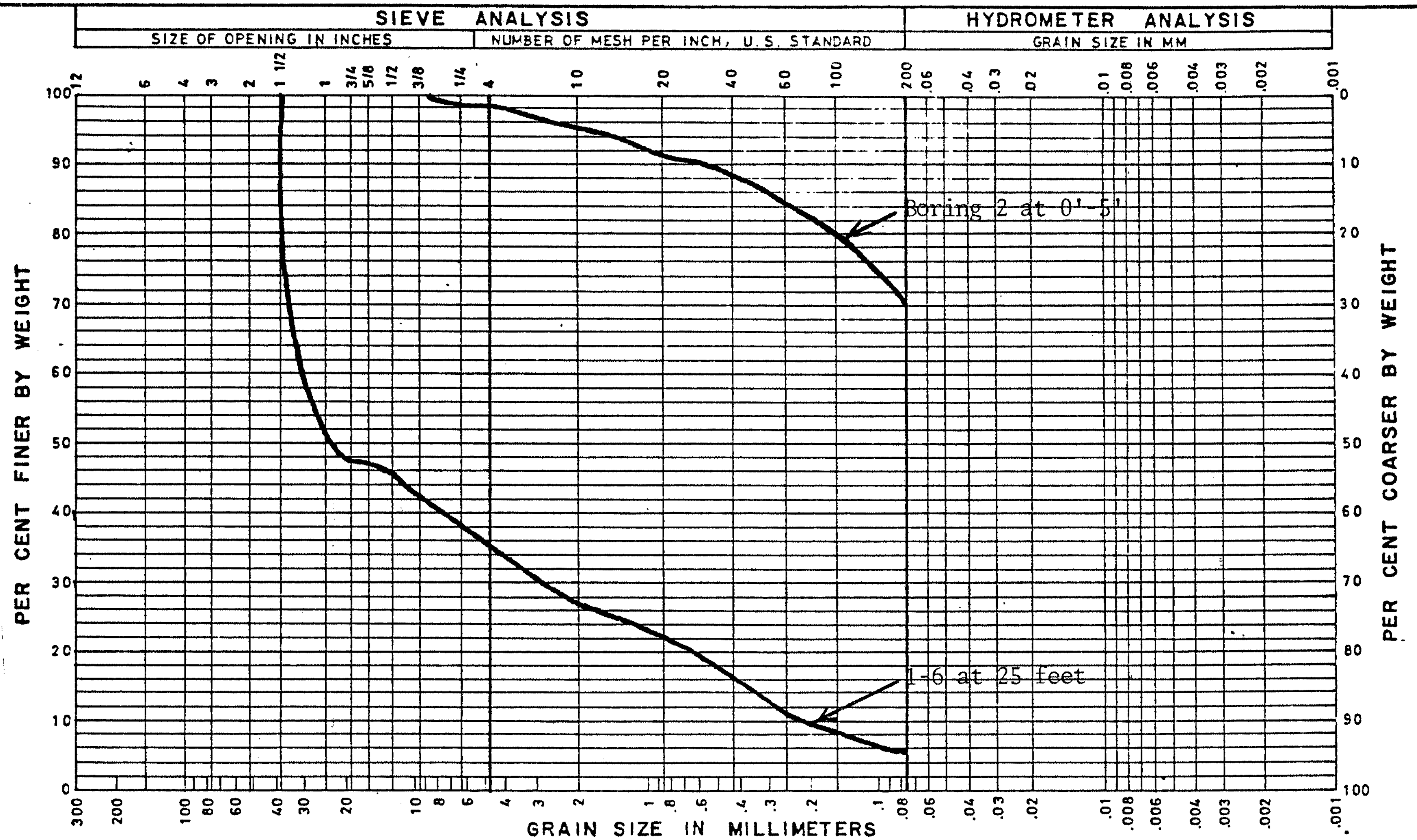
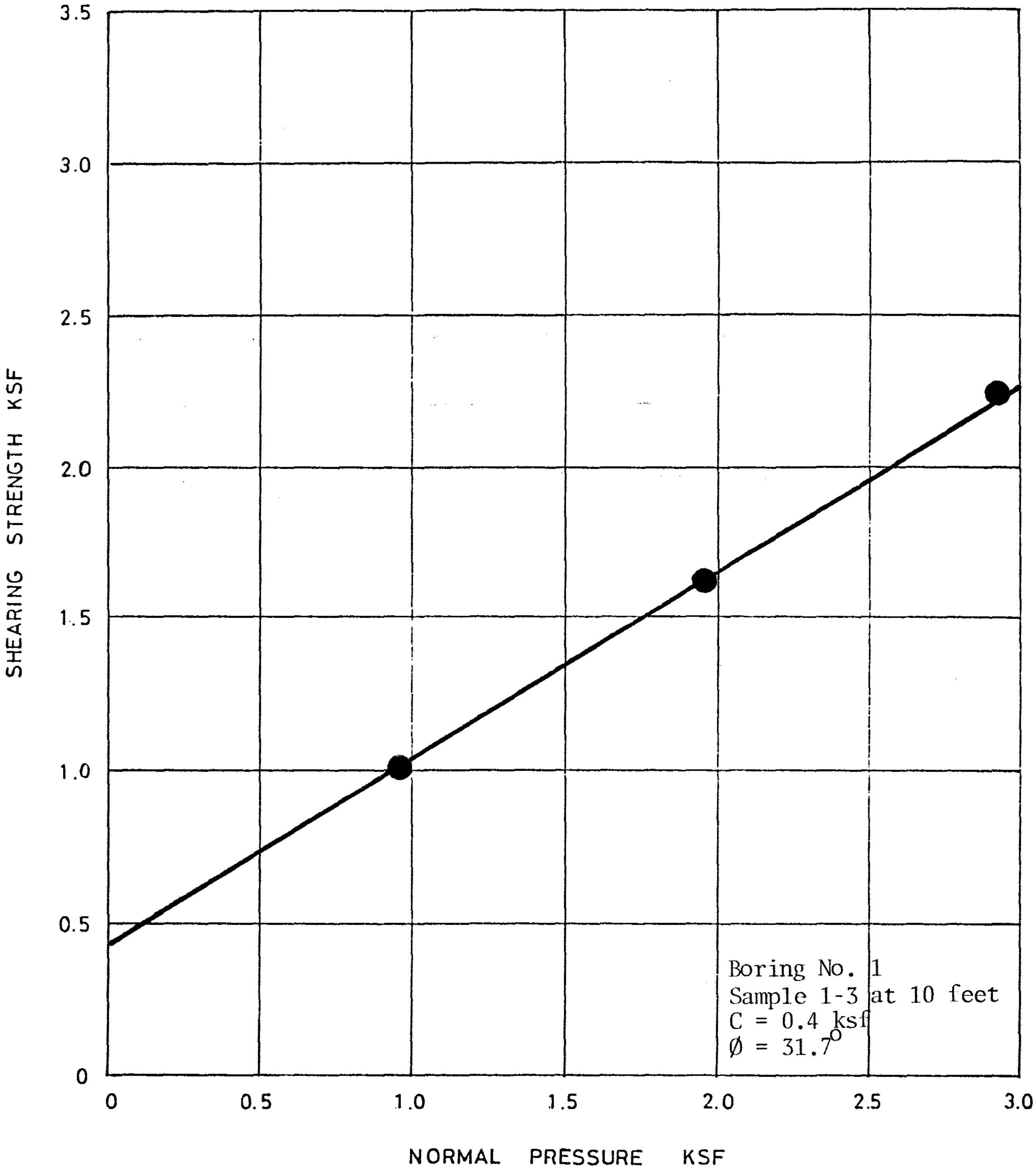


COBBLES	GRAVEL		SAND			FINES
	COARSE	FINE	COARSE	MEDIUM	FINE	

SAMPLE NO.	DEPTH - FT.	U.S.C.	CLASSIFICATION	NAT W.C.%	LL	PL	PI
1-6	25 feet	GW	Brown Sandy GRAVELS	9.1			
Boring2	0-5 feet	CL	Dark Brown Sandy CLAY	7.8			

GRAIN SIZE CLASSIFICATION

SHEAR TEST DIAGRAM



Boring No. 1
Sample 1-3 at 10 feet
C = 0.4 ksf
Ø = 31.7°

Key:
○ Tests at field moisture content
● Tests at saturated moisture content

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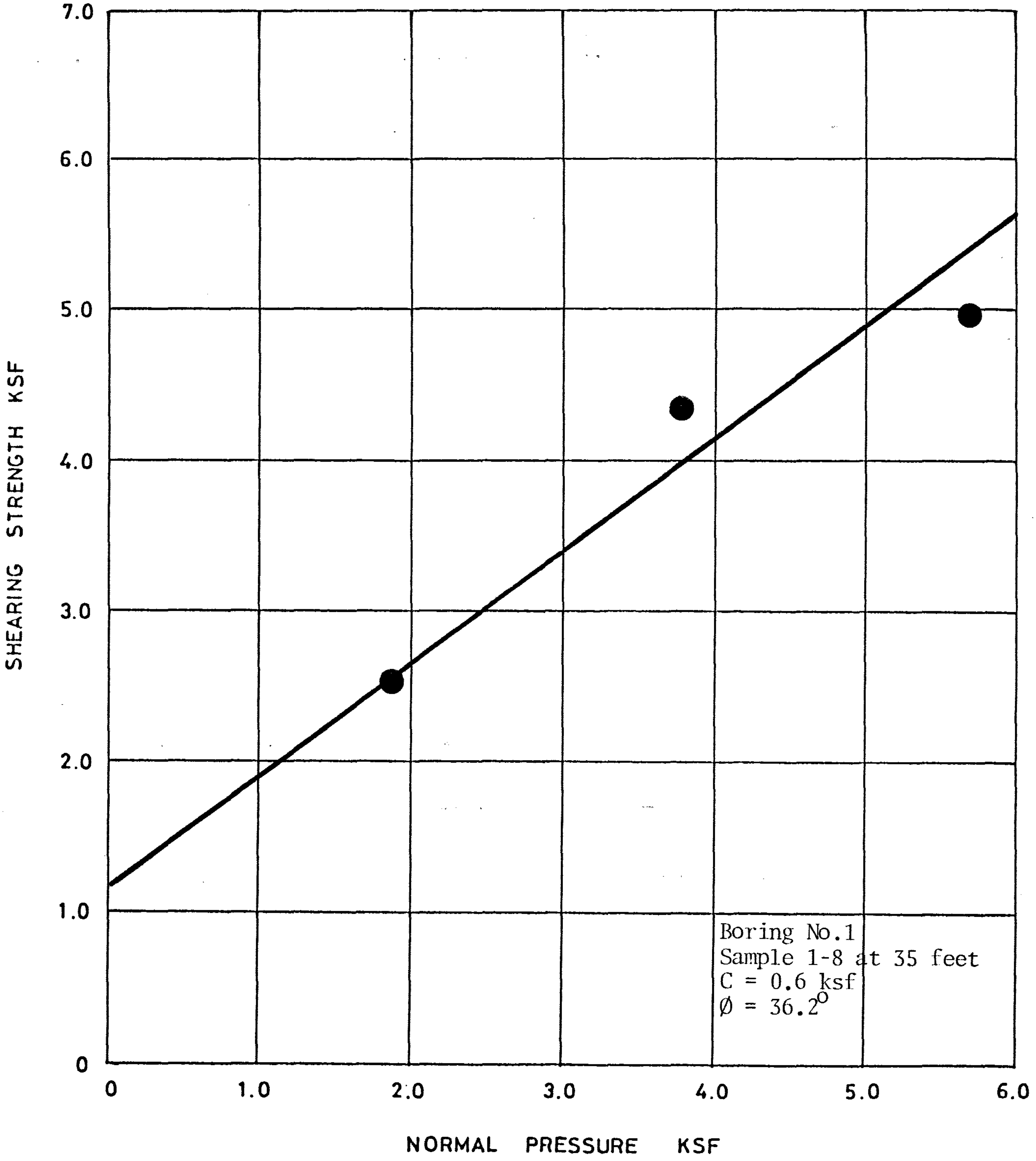
PLATE A-4

SHEAR TEST DIAGRAM



Boring No.1
Sample 1-8 at 35 feet
C = 0.6 ksf
Ø = 36.2°

Key:
○ Tests at field moisture content
● Tests at saturated moisture content

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Matadero Creek U-frame Channel
Palo Alto, California

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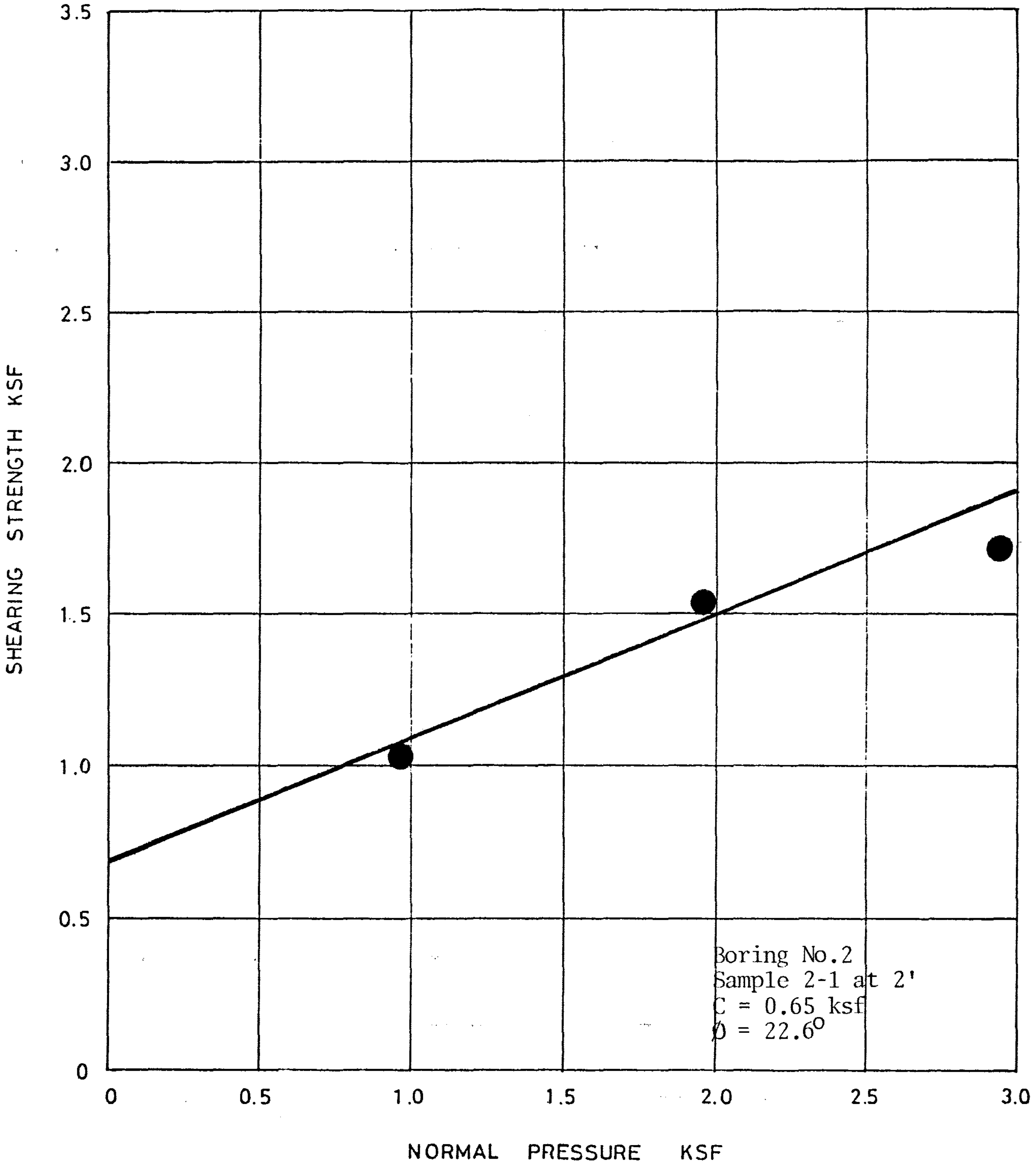
SHEAR TEST DIAGRAM



Key:
- ○ Tests at field moisture content
- ● Tests at saturated moisture content

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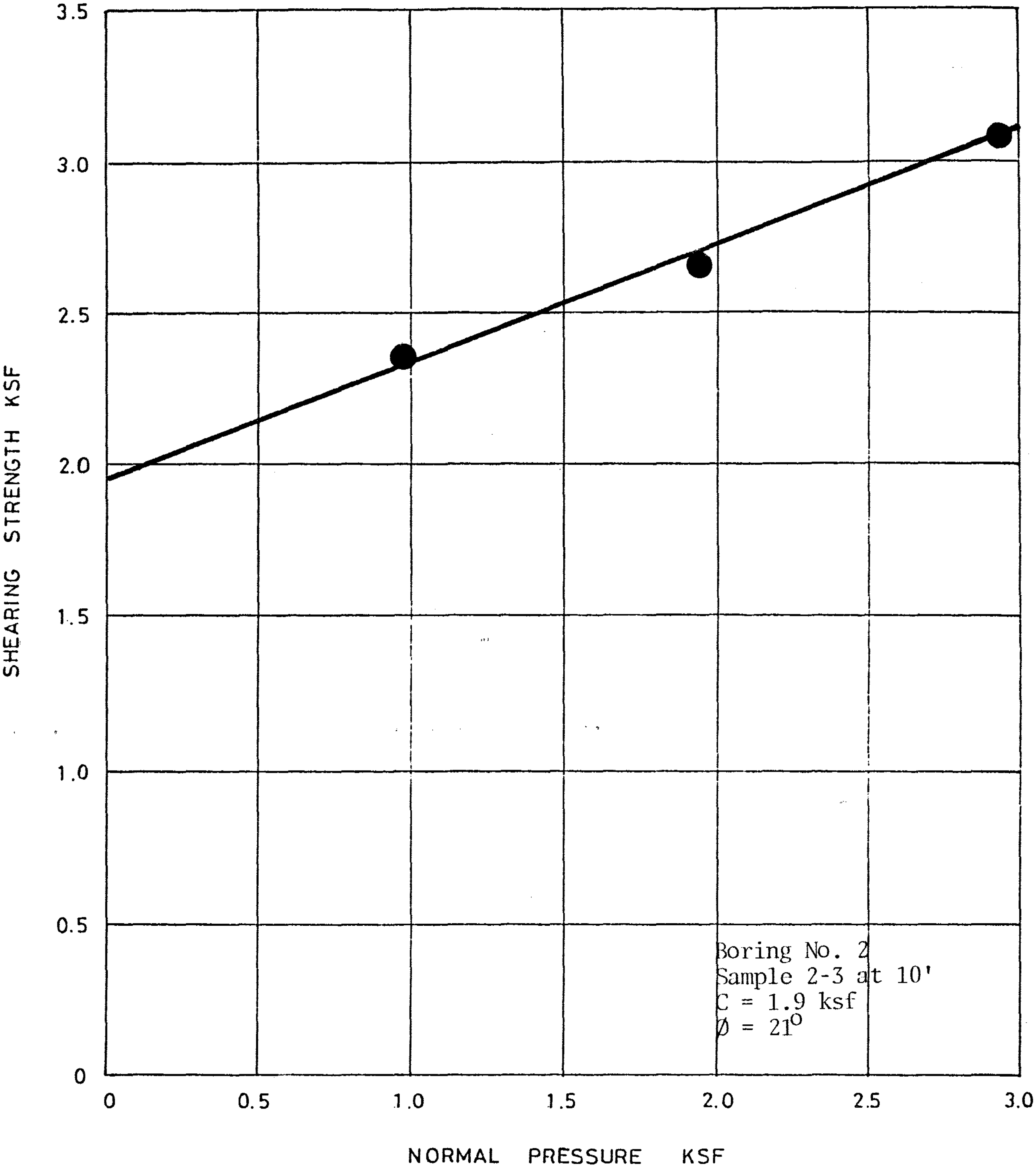
Matadero Creek U-frame Channel
Palo Alto, California

DATE : 12/1/89
JOB NO : 89148.10

PLATE A-6

SHEAR TEST DIAGRAM



Boring No. 2
Sample 2-3 at 10'
C = 1.9 ksf
Ø = 21^{o}

Key:
○ Tests at field moisture content
● Tests at saturated moisture content

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Palo Alto, California

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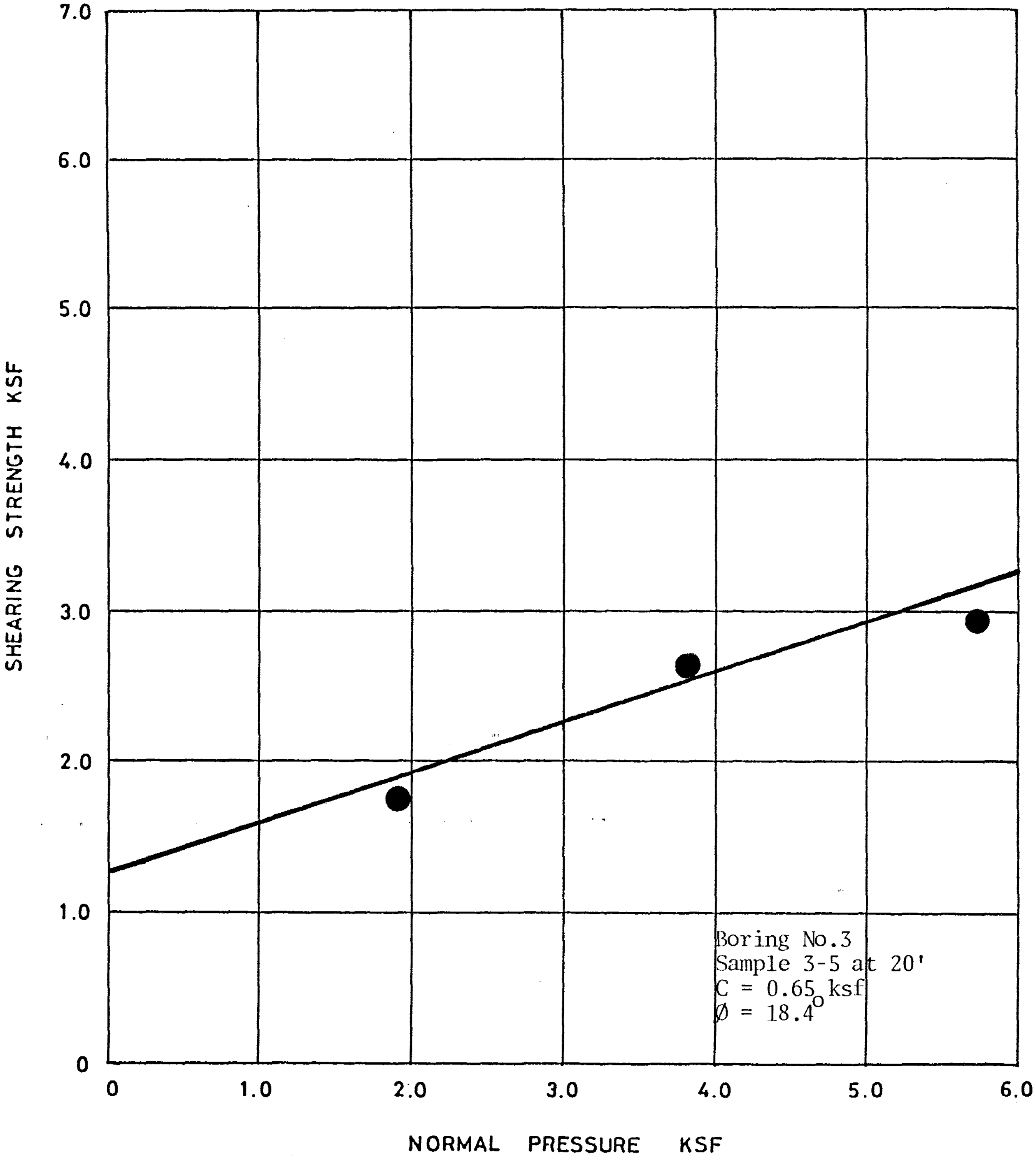
PLATE A-7

SHEAR TEST DIAGRAM



Boring No.3
Sample 3-5 at 20'
$C = 0.65$ ksf
$\phi = 18.4^{\circ}$

Key:
- ○ Tests at field moisture content
- ● Tests at saturated moisture content

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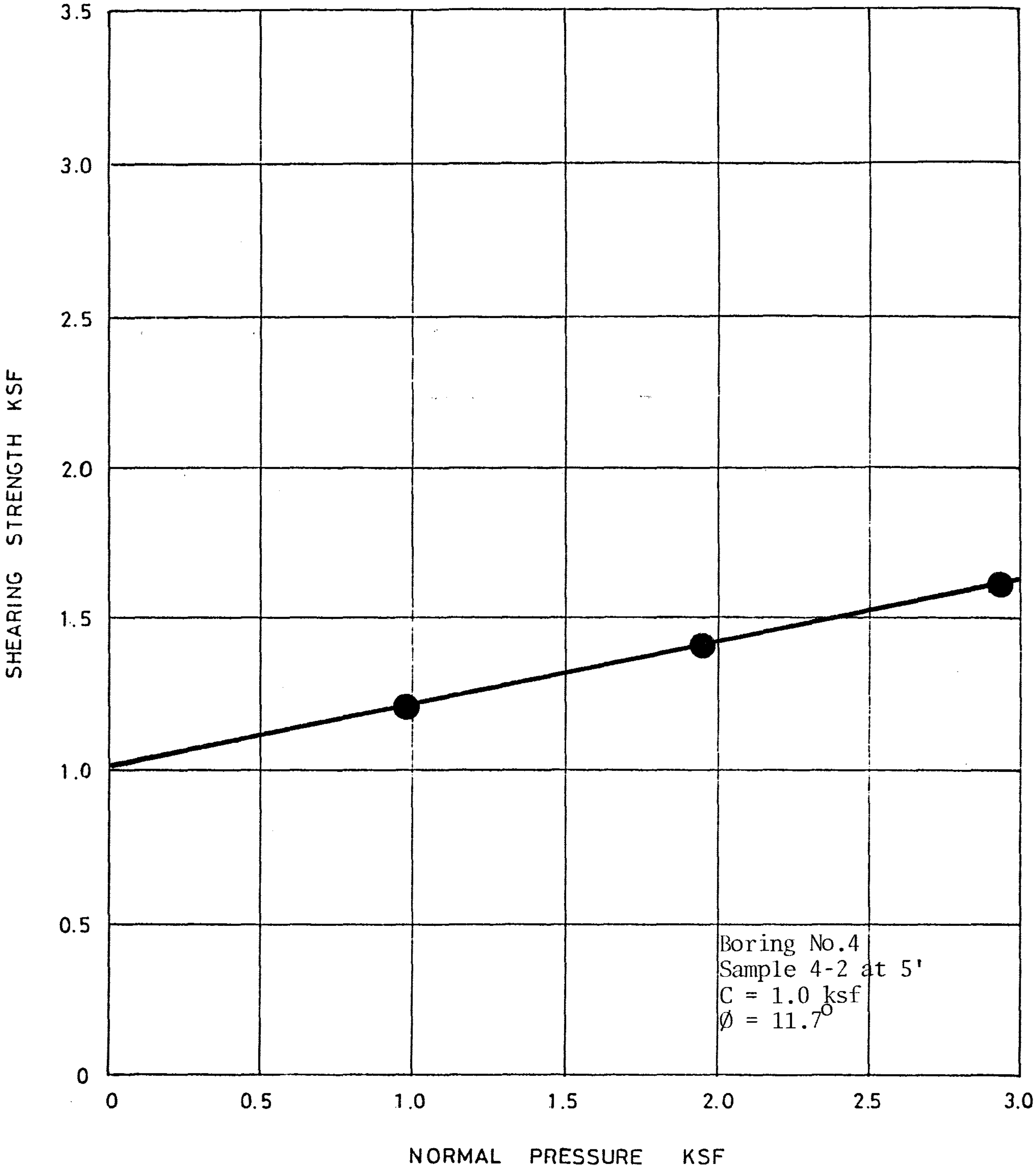
DATE : 12/1/89	**JOB NO :** 89148.10

SHEAR TEST DIAGRAM



Boring No.4
Sample 4-2 at 5'
C = 1.0 ksf
Ø = 11.7°

Key:
○ Tests at field moisture content
● Tests at saturated moisture content

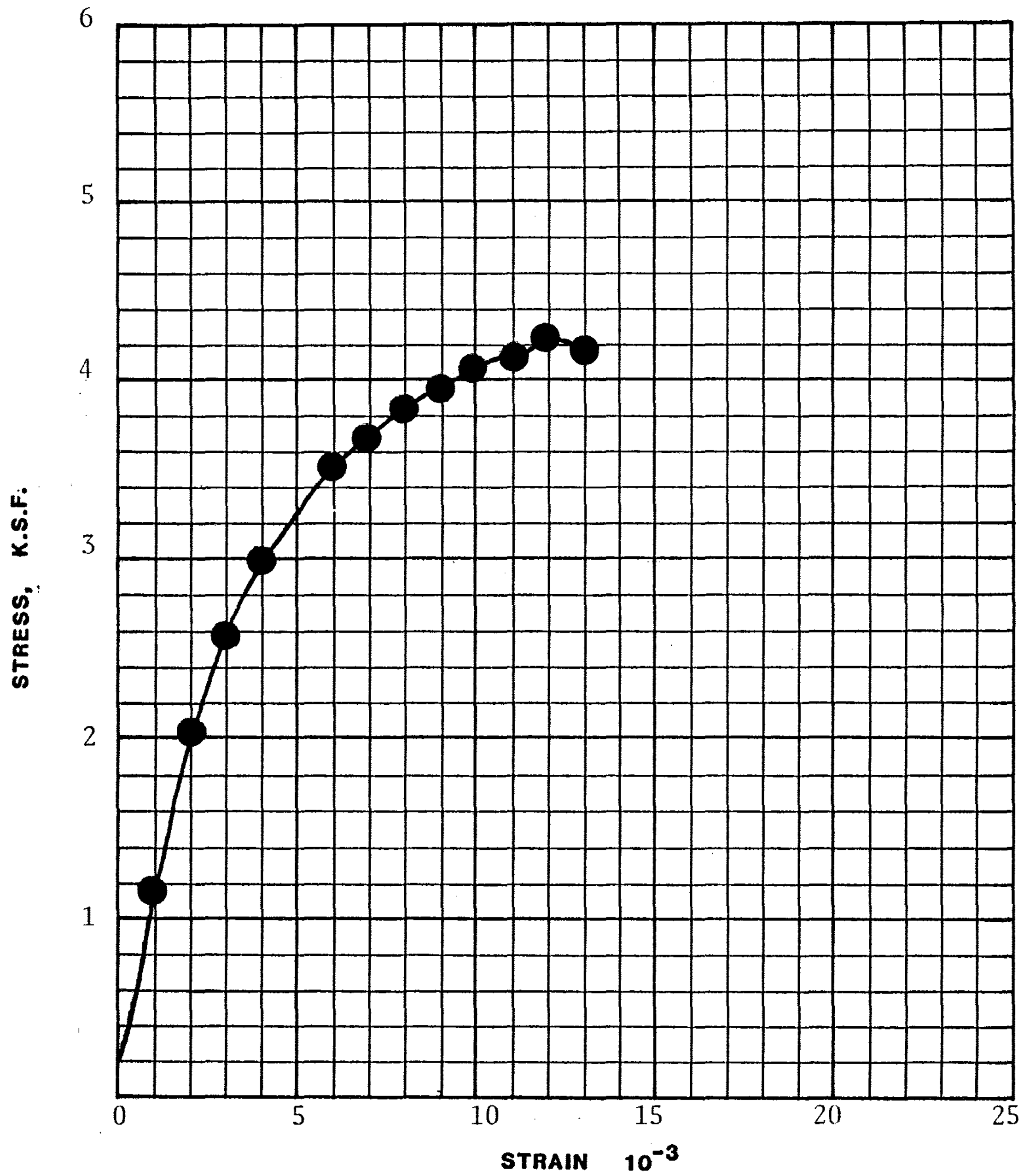
PSC ASSOCIATES, INC.
SOILS, FOUNDATION AND GEOLOGICAL ENGINEERS

Matadero Creek U-frame Channel
Palo Alto, California

DATE : 12/1/89 **JOB NO :** 89148.10

PLATE A-9

UNCONFINED COMPRESSION TEST



BORING NO. 4 SAMPLE NO. 4-3 ELEV. OR DEPTH 5 feet

SPECIMEN DIAMETER (IN.) 2.425 SPECIMEN HEIGHT (IN.) 5.0

DESCRIPTION Light Brown Silty CLAY

REMARKS

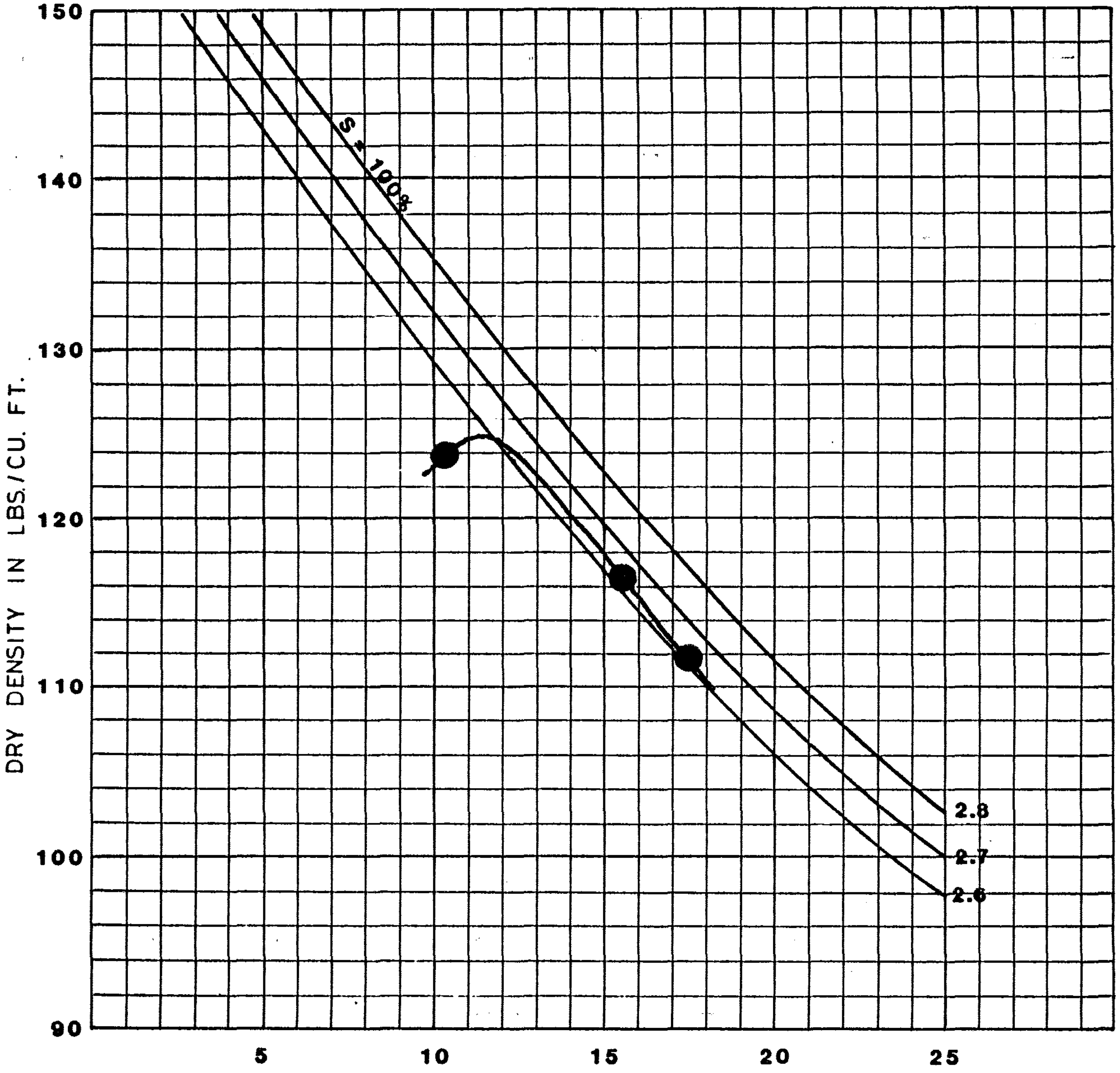
PSC ASSOCIATES, INC.

SOILS, FOUNDATION AND GEOLOGICAL ENGINEERS

Matadero Creek U-frame Channel
Palo Alto, California

DATE : 12/1/89 **JOB NO :** 89148.10

COMPACTION TEST DATA



MOISTURE CONTENT IN % OF DRY WEIGHT

BORING NO. 2 DEPTH 0-5' ELEVATION
SOIL Dark Brown Sandy CLAY
LOCATION Boring No. 2
OPTIMUM MOISTURE CONTENT 11.1%
MAXIMUM DRY DENSITY 125.0 pcf.
METHOD OF COMPACTION ASTM D1557 (A)

PSC ASSOCIATES, INC.
SOILS, FOUNDATION AND GEOLOGICAL ENGINEERS

Matadero Creek U-frame Channel
Palo Alto, California

DATE : 12/1/89 **JOB NO :** 89148.10

PLATE A-11

APPENDIX B

RECOMMENDED GENERAL GRADING SPECIFICATIONS

1.1 General Description

1.11 These specifications have been prepared for general grading and site development of this project. PSC Associates, Inc., hereinafter described as the Soil Engineer, should be consulted at least 4 days prior to any work connected with the existence of these specifications.

1.12 The work shall include all clearing and grubbing, preparation of land to be filled including benching and keying, filling of the land, spreading, compaction, density testing of the fill, and disposal of excess materials to complete the grading of areas in conformance with the lines, grades and slopes as shown on the grading plans.

1.13 In the event that any unusual conditions, not covered by these specifications, are encountered during grading operations, the Soil Engineer shall be immediately notified.

2.1 Clearing, Grubbing and Preparing Areas to be Filled

2.11 All timber, roots, brush, sod, abandoned buildings (surface and subsurface), debris and other deleterious materials shall be removed to approved disposal areas. This work includes dust control as required to alleviate any nuisance on or about the site. No burning shall be permitted in areas to be filled.

2.12 All loose soil, organic matter subject to decay, topsoil and spongy material shall be removed from the surface upon which the fill is to be placed; the exposed surface shall be free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction. The subgrade shall be approved by the Soil Engineer prior to placing fill.

2.13 Where ground surface to receive fill is steeper than a gradient of 5 horizontal to 1 vertical (5:1), a fill stabilizing key shall be excavated into a subgrade that is competent and suitable for receiving fill after all loose soil, organic matter, topsoil, and spongy material have been removed in accordance with paragraph 2.12. The bottom of the key should be at least 12 feet wide and should slope into the hillside at a gradient of at least 2%.

2.14 The ground upon which the fill is to be placed shall be plowed or scarified to the recommended depth (usually 6 to 8 inches). Scarification of subgrade may be waived upon written approval of the Soil Engineer.

2.15 After the area to receive the fill has been cleared, approved, and scarified, it shall be disced or bladed until it is uniform and free from large clods, brought to the proper moisture content by adding water and mixing or aerating, and compacted to not less than 90% of maximum dry density as determined by ASTM Designation No. D 1557-78. Testing will be performed by the Soil Engineer.

2.16 Loose soils removed in accordance with paragraph 2.12, if free from deleterious materials, may be incorporated in compacted fill.

3.1 Materials

3.11 The materials for the engineered fill shall be approved by the Soil Engineer at least four days before commencement of grading operations. Any imported materials must be approved before being brought to the site. The materials used shall be free of solid lumps, clods and any deleterious substances. No rocks larger than six inches in dimension will be permitted in mass fills unless they are placed at the direction of the Soil Engineer.

3.12 The native soil, if free of organic or other deleterious material, may be used as fill.

3.13 The contractor shall notify the Soil Engineer at least four working days in advance of his intention to import soil from any source outside the project areas and shall permit the Soil Engineer to sample as necessary for the purpose of making tests to establish the qualities of these materials. The contractor shall be responsible for all cost incurred in sampling, testing, analyzing, and determining the applicability of the materials for use on the site. The work shall be performed by the Soil Engineer.

4.1 Placing, Spreading and Compacting Fill Material

4.11 The fill material shall be placed in horizontal layers which, when compacted, shall not exceed 6 inches in thickness. Each horizontal layer shall be spread evenly and shall be thoroughly mixed to minimize segregation and to provide uniformity of material in each layer.

4.12 When fill material includes oversized rock, they shall be placed according to the recommendations of the Soil Engineer in areas designated as suitable for rock disposal. No rocks larger than 6 inches will be permitted closer than 5 feet below the finished grade.

4.13 When the moisture content of the fill material is below that necessary to obtain the required density, water shall be added and thoroughly mixed into the soil. When the moisture content of the fill material is above the necessary to obtain the required density, the fill material shall be aerated by blading or other methods.

4.14 After each layer has been placed, it shall be thoroughly compacted to not less than 90% of maximum dry density as determined by ASTM Designation No. D 1557-78. Testing will be performed by the Soil Engineer.

4.15 Compaction of each layer shall be continuous over its entire area and continued out to the finished slope face.

5.1 Tests

5.11 The test used to define maximum densities of all compaction work shall be the ASTM Designation No. D 1557-78. All densities shall be expressed as a percentage of the maximum dry density obtained in the laboratory by the foregoing procedure.

5.12 Field density tests will be performed by the Soil Engineer. The location and number of tests will be determined by the Soil Engineer or applicable specifications.

5.13 Earthwork shall not be performed without approval by the Soil Engineer. Deviations from these specifications will not be allowed except by written variations signed by the Soil Engineer.

6.1 Seasonal Requirements

6.1 No fill shall be placed during unfavorable weather conditions as determined by the Soil Engineer. After interruption of work due to heavy rain, the Soil Engineer shall approve previously placed fill before resumption of earthmoving operations.

APPENDIX C

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Hayward, California 94545 *(415) 783-6960*

TAL

DEC 01 1989

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89

CUSTOMER: PSC Associates, Inc.
REQUESTER: Steve K. Tsang
PROJECT: No. 89148.10, Matadero Creek, U-Frame Channel

		Sample Type: Soil			
		2-2		5-2	
Method and Constituent	Units	Concentration	Detection Limit	Concentration	Detection Limit
EPA Method 8080:					
Aldrin	ug/kg	< 0.1	0.1	< 0.1	0.1
α-BHC	ug/kg	< 0.1	0.1	< 0.1	0.1
β-BHC	ug/kg	< 0.1	0.1	< 0.1	0.1
δ-BHC	ug/kg	< 0.1	0.1	< 0.1	0.1
γ-BHC (Lindane)	ug/kg	< 0.1	0.1	< 0.1	0.1
Chlordane	ug/kg	< 0.1	0.1	< 0.1	0.1
4,4'-DDD	ug/kg	< 0.1	0.1	< 0.1	0.1
4,4'-DDE	ug/kg	7.2	0.3	< 0.1	0.1
4,4'-DDT	ug/kg	4.4	0.1	< 0.1	0.1
Dieldrin	ug/kg	< 0.1	0.1	< 0.1	0.1
Endosulfan I	ug/kg	< 0.1	0.1	< 0.1	0.1
Endosulfan II	ug/kg	< 0.1	0.1	< 0.1	0.1
Endosulfan sulfate	ug/kg	< 0.1	0.1	< 0.1	0.1
Endrin	ug/kg	< 0.1	0.1	< 0.1	0.1
Endrin aldehyde	ug/kg	< 0.1	0.1	< 0.1	0.1
Heptachlor	ug/kg	< 0.1	0.1	< 0.1	0.1
Heptachlor epoxide	ug/kg	< 0.1	0.1	< 0.1	0.1
Methoxychlor	ug/kg	< 0.1	0.1	< 0.1	0.1
Toxaphene	ug/kg	< 0.1	0.1	< 0.1	0.1

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Two

		Sample Type: Soil			
		2-2		5-2	
Method and Constituent	Units	Concentration	Detection Limit	Concentration	Detection Limit
EPA Method 8080, (Continued):					
Aroclor 1016	ug/kg	< 0.2	0.2	< 0.2	0.2
Aroclor 1221	ug/kg	< 0.2	0.2	< 0.2	0.2
Aroclor 1232	ug/kg	< 0.2	0.2	< 0.2	0.2
Aroclor 1242	ug/kg	< 0.2	0.2	< 0.2	0.2
Aroclor 1248	ug/kg	< 0.2	0.2	< 0.2	0.2
Aroclor 1254	ug/kg	< 0.2	0.2	< 0.2	0.2
Aroclor 1260	ug/kg	< 0.2	0.2	< 0.2	0.2

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Three

Sample Type: Soil

Method and Constituent	Units	2-2 Concentration	2-2 Detection Limit	5-2 Concentration	5-2 Detection Limit
EPA Method 8240:					
Chloromethane	ug/kg	< 20	20	< 20	20
Bromomethane	ug/kg	< 20	20	< 20	20
Vinyl chloride	ug/kg	< 20	20	< 20	20
Chloroethane	ug/kg	< 20	20	< 20	20
Methylene chloride	ug/kg	< 20	20	< 20	20
Trichlorofluoromethane	ug/kg	< 10	10	< 10	10
1,1-Dichloroethene	ug/kg	< 20	20	< 20	20
1,1-Dichloroethane	ug/kg	< 20	20	< 20	20
trans-1,2-Dichloroethene	ug/kg	< 20	20	< 20	20
Chloroform	ug/kg	< 20	20	< 20	20
1,2-Dichloroethane	ug/kg	< 20	20	< 20	20
1,1,1-Trichloroethane	ug/kg	< 10	10	< 10	10
Carbon tetrachloride	ug/kg	< 10	10	< 10	10
Bromodichloromethane	ug/kg	< 20	20	< 20	20
1,2-Dichloropropane	ug/kg	590	30	< 30	30
trans-1,3-Dichloropropene	ug/kg	< 20	20	< 20	20
Trichloroethene	ug/kg	< 20	20	< 20	20
Benzene	ug/kg	< 20	20	< 20	20
Dibromochloromethane	ug/kg	< 30	30	< 30	30
1,1,2-Trichloroethane	ug/kg	< 50	50	< 50	50
cis-1,3-Dichloropropene	ug/kg	< 20	20	< 20	20
2-Chloroethylvinyl ether	ug/kg	< 600	600	< 600	600
Bromoform	ug/kg	< 50	50	< 50	50
1,1,2,2-Tetrachloroethane	ug/kg	< 100	100	< 100	100
Tetrachloroethene	ug/kg	< 10	10	< 10	10
Toluene	ug/kg	1,200	10	840	10

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Four

Sample Type: Soil

Method and Constituent	Units	2-2 Concentration	2-2 Detection Limit	5-2 Concentration	5-2 Detection Limit
EPA Method 8240, (Continued):					
Chlorobenzene	ug/kg	< 10	10	< 10	10
Ethylbenzene	ug/kg	210	10	200	10
1,3-Dichlorobenzene	ug/kg	< 20	20	< 20	20
1,2-Dichlorobenzene	ug/kg	< 500	500	< 500	500
1,4-Dichlorobenzene	ug/kg	< 40	40	< 40	40

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Five

Sample Type: Soil

Method and Constituent	Units	2-2 Concentration	2-2 Detection Limit	5-2 Concentration	5-2 Detection Limit
EPA Method 8270:					
N-Nitrosodimethylamine	ug/kg	< 300	300	< 300	300
Phenol	ug/kg	< 300	300	< 300	300
bis(-2-Chloroethyl) Ether	ug/kg	< 300	300	< 300	300
2-Chlorophenol	ug/kg	< 300	300	< 300	300
1,3-Dichlorobenzene	ug/kg	< 300	300	< 300	300
1,4-Dichlorobenzene	ug/kg	< 300	300	< 300	300
1,2-Dichlorobenzene	ug/kg	< 300	300	< 300	300
N-Nitroso-Di-n-Propylamine	ug/kg	< 300	300	< 300	300
Hexachloroethane	ug/kg	< 300	300	< 300	300
Nitrobenzene	ug/kg	< 300	300	< 300	300
Isophorone	ug/kg	< 300	300	< 300	300
2-Nitrophenol	ug/kg	< 300	300	< 300	300
2,4-Dimethylphenol	ug/kg	< 300	300	< 300	300
bis(-2-Chloroethoxy) Methane	ug/kg	< 300	300	< 300	300
2,4-Dichlorophenol	ug/kg	< 300	300	< 300	300
1,2,4-Trichlorobenzene	ug/kg	< 300	300	< 300	300
Naphthalene	ug/kg	< 300	300	< 300	300
Hexachlorobutadiene	ug/kg	< 300	300	< 300	300
4-Chloro-3-Methyl-phenol	ug/kg	< 300	300	< 300	300
Hexachlorocyclo-pentadiene	ug/kg	< 300	300	< 300	300
2,4,6-Trichlorophenol	ug/kg	< 300	300	< 300	300
2-Chloronaphthalene	ug/kg	< 300	300	< 300	300
Dimethyl Phthalate	ug/kg	< 300	300	< 300	300
Acenaphthylene	ug/kg	< 300	300	< 300	300
Acenaphthene	ug/kg	< 300	300	< 300	300

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Six

Method and Constituent	Units	Sample Type: Soil 2-2 Concentration	 2-2 Detection Limit	 5-2 Concentration	 5-2 Detection Limit
EPA Method 8270, (Continued):					
2,4-Dinitrophenol	ug/kg	< 300	300	< 300	300
4-Nitrophenol	ug/kg	< 300	300	< 300	300
2,4-Dinitrotoluene	ug/kg	< 300	300	< 300	300
2,6-Dinitrotoluene	ug/kg	< 300	300	< 300	300
Diethylphthalate	ug/kg	< 300	300	< 300	300
4-Chlorophenyl-phenylether	ug/kg	< 300	300	< 300	300
Fluorene	ug/kg	< 300	300	< 300	300
N-Nitrosodiphenylamine	ug/kg	< 300	300	< 300	300
4-Bromophenyl-phenylether	ug/kg	< 300	300	< 300	300
Hexachlorobenzene	ug/kg	< 300	300	< 300	300
Pentachlorophenol	ug/kg	< 300	300	< 300	300
Phenanthrene	ug/kg	< 300	300	< 300	300
Anthracene	ug/kg	< 300	300	< 300	300
Di-n-Butylphthalate	ug/kg	< 300	300	< 300	300
Fluoranthene	ug/kg	< 300	300	< 300	300
Benzidine	ug/kg	< 300	300	< 300	300
Pyrene	ug/kg	< 300	300	< 300	300
Butylbenzylphthalate	ug/kg	< 300	300	< 300	300
3,3'-Dichlorobenzidine	ug/kg	< 300	300	< 300	300
Benzo(a)Anthracene	ug/kg	< 300	300	< 300	300
bis(2-Ethylhexyl) Phthalate	ug/kg	< 300	300	< 300	300
Chrysene	ug/kg	< 300	300	< 300	300
Di-n-Octyl Phthalate	ug/kg	< 300	300	< 300	300
Benzo(b)Fluoranthene	ug/kg	< 300	300	< 300	300
Benzo(k)Fluoranthene	ug/kg	< 300	300	< 300	300

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Seven

Sample Type: Soil

Method and Constituent	Units	2-2 Concentration	2-2 Detection Limit	5-2 Concentration	5-2 Detection Limit
EPA Method 8270, (Continued):					
Benzo(a)Pyrene	ug/kg	< 300	300	< 300	300
Indeno(1,2,3-cd)Pyrene	ug/kg	< 300	300	< 300	300
Dibenzo(a,h)Anthracene	ug/kg	< 300	300	< 300	300
Benzo(g,h,i)Perylene	ug/kg	< 300	300	< 300	300

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Eight

Sample Type: Soil

Method and Constituent	Units	2-2		5-2	
		Concentration	Detection Limit	Concentration	Detection Limit
EPA Method 7041:					
Sb	ug/kg	250	90	340	90
EPA Method 7061:					
As	ug/kg	4,600	10	5,100	10
EPA Method 7090:					
Be	ug/kg	< 300	300	< 300	300
EPA Method 7130:					
Cd	ug/kg	< 1,000	1,000	< 1,000	1,000
EPA Method 7190:					
Cr	ug/kg	40,000	5,000	42,000	5,000
EPA Method 7210:					
Cu	ug/kg	54,000	3,000	60,000	3,000
EPA Method 7420:					
Pb	ug/kg	25,000	4,000	11,000	4,000
EPA Method 7471:					
Hg	ug/kg	77	3	280	3
EPA Method 7520:					
Ni	ug/kg	51,000	3,000	53,000	3,000
EPA Method 7741:					
Se	ug/kg	< 50	50	< 50	50
EPA Method 7760:					
Ag	ug/kg	< 500	500	< 500	500
EPA Method 7841:					
Tl	ug/kg	< 80	80	< 80	80

DATE: 11/28/89
LOG NO.: 8040
DATE SAMPLED: 11/9/89
DATE RECEIVED: 11/9/89
PAGE: Nine

Sample Type: Soil

Method and Constituent	Units	2-2		5-2	
		Concentration	Detection Limit	Concentration	Detection Limit
EPA Method 7950:					
Zn	ug/kg	81,000	2,000	65,000	2,000
EPA Method 9010:					
Cyanide	ug/kg	< 2	2	< 2	2
EPA Interim Method for the Determination of Asbestos in Bulk Insulation Samples		ND*	< 1%	ND*	< 1%

ND*: None Detected

Louis W. DuPuis
Quality Assurance/Quality Control Manager

LWD:vll

APR 11 1990